Appl. No. : **10/642,358**
Filed : **August 15, 2003**

REMARKS

In the March 29, 2004 Office Action, the Examiner rejects Claims 19-25 and 50 under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent No. 5,109,425 to Lawton, et al. ("Lawton") in view of U.S. Patent No. 5,838,828 to Mizuki, et al. ("Mizuki") and rejects Claim 26 under 35 U.S.C. § 103(a) as unpatentable over Lawton in view of Mizuki and further in view of U.S. Patent Application Publication No. U.S. 2004/0017937 by Silverstein. Applicants request reconsideration of the rejections in view of the following remarks.

Preliminary Matters

Applicants note that a Supplemental Information Disclosure Statement was recently submitted on June 16, 2004. The Supplemental Information Disclosure Statement lists an International Search Report from a corresponding PCT application.

Allowable Subject Matter

Applicants thank the Examiner for allowing Claims 1-18, 27-49, 51, and 52. Applicants note that in stating that Claims 1-18, 27-49, 51, and 52 are allowable, the Examiner paraphrases the claims. To the extent that the language used in paraphrasing the claims varies from the language of the allowable claims, Applicants respectfully disagree with the paraphrasing.

For example, the Examiner appears to have substituted "unchanged" for "changed." Applicants also respectfully disagree with the Examiner's stated reasons for allowability to the extent that there is any implication that the patentability of the claims rests on the recitation of particular features. Applicants note that it is the combination of features that makes a claim patentable.

Applicants also note that allowed Claim 1 has been amended herein to correct a minor typographical error as explained below.

Amendment to Allowed Claim 1

Applicants have amended Claim 1 herein to correct a typographical error, which resulted in inconsistent terminology. Claim 1 has been amended by changing "the mobile object" to "the mobile robot." The terminology "the mobile robot" has antecedent basis support in Claim 1. Applicants request allowance of amended Claim 1.

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Discussion of Rejection of Claim 19 Under 35 U.S.C. § 103(a) over Lawton in view of Mizuki

The Examiner rejects Claim 19 under 35 U.S.C. § 103(a) as unpatentable over Lawton in view of Mizuki. In rejecting Claim 19, the Examiner states:

> Lawton discloses "comparing the amounts of spatial gradient of a first image to the amounts of spatial gradients of a second video image to detect the motional state of the mobile robot (column 1, lines 32-39: temporal gradient between two images is computed and then used to determine the movement of objects in the field of view, thereby ascertaining the movement of the mobile robot).

Applicants note that in the above-quoted passage, the Examiner has paraphrased certain elements of Claim 19. To the extent that the language used in the Examiner's rejection varies from the language of the claim, Applicants respectfully disagree with the paraphrasing.

The Examiner also acknowledges that Lawton by itself does not teach or suggest all the claimed elements. The Examiner states that "Lawton does not disclose characterizing the pixels into two groups corresponding to higher and lower spatial gradients and then using the characterization of the pixels for comparing two different video images." The Examiner uses Mizuki to provide the missing element.

Applicants respectfully traverse the Examiner's rejection, and Applicants respectfully submit that the Examiner has not met the burden of establishing a prima facie case of obviousness. As set forth in M.P.E.P. §2143:

> To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Applicants respectfully submit that there is no suggestion or motivation to combine the teachings of Lawton and Mizuki and that even if Lawton and Mizuki were to be combined, the combination of Lawton and Mizuki does not teach or suggest all the claim limitations.

There is no suggestion or motivation to combine Lawton and Mizuki in the manner proposed by the Examiner. The Examiner states that "it would have been obvious to one skilled in the art to modify Lawton by Mizuki to characterize the pixels as claimed (i.e. binarize the pixels) and then use the binary representation of the pixels for the subsequent (temporal)

comparison" because "[t]his extra binarizing step reduces the complexity of the temporal comparison – only single bits are compared for each pixel rather than eight or more."

Applicants respectfully disagree. Lawton teaches away from such a combination because Lawton already teaches an alternative way of efficient computing. Lawton states that "[i]t is yet another object of this invention to provide a machine vision control system for controlling robotic type devices, or the like, in a manner which eliminates unnecessary data from the computations so that the computations performed can be accomplished in real-time."

Lawton's efficient solution relates "to employ[ing] a computer-based, real-time system to process the image signals ... and thereby, *emulate the human response* in a machine vision environment," (emphasis added). See Col. 3, line 67 to Col. 4, line 4. Lawton describes the human response as "[t]he human's predictive approach is one wherein the scene is viewed in real-time and the movement is *divided into relevant and non-relevant areas*," (emphasis added). See Col. 3, lines 26 to 29. With respect to Figures 1 to 3, Lawton describes that "[s]ince it is in the foreground area 12, however, *it is not relevant* to the mapping of the objects of interest (i.e. the building 18 and tree 20) and, therefore, all data relevant to the apparent 'movement' thereof (*which would be processed in a typical prior art system*) *can be discarded*," (emphasis added). See Col. 6, lines 25-30. Thus, Lawton teaches discarding data to decrease computations. The Examiner states that Mizuki teaches "binarizing" data to decrease computations. Because Lawton and Mizuki teach diverging techniques of reducing the complexity of calculation, Applicants respectfully submit that it is not obvious to combine the teachings of Lawton and Mizuki.

Applicants further submit that to modify Lawton with Mizuki as suggested by the Examiner would change the principle of operation of the Lawton reference, and thus, Lawton and Mizuki cannot be combined in the manner suggested. "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). See M.P.E.P.§2143.01. The Examiner proposes modifying Lawton by "binarizing the spatial gradient calculation prior to the temporal gradient calculation."

Lawton uses Gabor filters. "[T]he output of paired Gabor filters (in quadrature phase) are summed across the background frame of reference to discriminate the direction of movement,"

see Col. 10, lines 31-33. "Sums and differences of paired filters in quadrature phase are taken to produce the spatiotemporally-oriented nonlinear responses that are selective for the direction of motion." See Col. 10, lines 49-52. Lawton describes "[t]he mathematical expressions that describe an even-symmetric Gabor function, F_{ES}, and an odd-symmetric Gabor function, F_{OS}, are:" (see Col. 10, lines 49-54), and Lawton expresses the formulae at Col. 10, lines 56 and 58.

The Examiner acknowledges that the Gabor functions that Lawton uses are not binary. In addition, Lawton notes that "[t]he Gabor filter is either a sine or a cosine multiplied times a Gaussian function. Gabor functions optimize resolution on a linear scale in both the spatial-position and spatial-frequency domains. Gabor functions optimize processing across space and over time. The Gaussian function acts as a spatially-localized smoothing function, *significantly reducing the sensitivity of the cell as the pattern moves away from the center of the cell's receptive field*," (emphasis added). See Col. 11, lines 1-9. Thus, it is important in Lawton not to "binarize" the data, or else the characteristic of the Gaussian function of the Gabor filter, i.e., "*significantly reducing the sensitivity of the cell as the pattern moves away from the center of the cell's receptive field*," would not be achieved. Accordingly, Lawton cannot be modified with Mizuki and "binarzed," in the manner suggested by the Examiner.

Further, even if Lawton and Mizuki were to be combined, the combination does not teach or suggest all the claim limitations. Applicants respectfully submit that neither Lawton nor Mizuki, alone or in combination, teach "using the characterization of the pixels to compare a first video image to a second video image to detect the motional state of the mobile robot" as claimed. To further clarify the distinctions over Lawton and Mizuki, Applicants have further amended Claim 19 to read "using the characterization of the pixels to compare a first video image to a second video image to detect the motional state of the mobile robot, wherein the motional state is selected from a set of possible motional states, the set comprising at least "in motion" and "not in motion."

Applicants respectfully maintain that the Examiner mischaracterizes the motion of objects taught in Lawton. The Examiner states that Lawton teaches "to detect the motional state of the mobile robot" at column 1, lines 32-39. Applicants respectfully disagree. Applicants respectfully submit that the motion described in Lawton relates to the motion of "objects moving against the background frame of reference," see Col. 1, lines 31-32 and not to the motion of a mobile robot. Lawton explains that his depth map generation uses "motion parallax that

measures the *velocity gradients between different points in the scene* (as described with respect to FIGS. 1-4)," see Col. 16, lines 14-16. Lawton further explains that "[u]sing motion parallax, distant objects can be ranged at high resolution by recording images along distances orthogonal to the line of sight being used to generate the depth map. Moving the vehicle over a longer distance is equivalent to increasing the baseline between the stereo cameras, increasing the amount of disparity between pictures at far distances. Thus, *both close and distant objects* can be ranged at high resolution when motion parallax is used to construct the depth map," see Col. 16, lines 28-37.

With respect to the motion of a vehicle, Lawton's motion parallax technique requires that motion exists. "Thus, motion parallax is the only technique that is useful for constructing and updating the depth map of a scene while the vehicle is in motion. When the vehicle is not moving and static images must be used to construct the depth map, stereo correlation is preferred to active ranging ..." see Col. 16, lines 19-24.

Lawton further describes that "[a] sequence of video images taken at small distance intervals by *horizontally scanning* a natural scene using cameras mounted on the current Mars Rover prototype (in the manner of FIG. 5) was used to measure motion parallax or *translational movement of the scene*," see Col. 16, lines 46-50. It is apparent that the Mars Rover as disclosed in Lawton must necessarily be in motion to horizontally scan a natural scene.

In addition, Lawton describes that "[t]he creation of the depth map and the *continuous estimation of the vehicle motion* was accomplished by scene analysis using paired even- and odd-symmetric filters that are normalized Gabor filters (a cosine times a Gaussian and a sine times a Gaussian), as described earlier herein." See Col. 16, lines 53-58. This indicates that the Mars Rover was continuously in motion. Thus, rather than teach or suggest a system that detects "using the characterization of the pixels to compare a first video image to a second video image to detect the motional state of the mobile robot," as claimed, Lawton's system apparently requires that motion exist.

Moreover, Applicants it does not appear to Applicants that "Mizuki discloses a process, similar to that of Lawton, for determining the presence of motion in a video image," as stated by the Examiner. Thus, neither Lawton nor Mizuki, alone or in combination, teaches or suggests "using the characterization of the pixels to compare a first video image to a second video image to detect the motional state of the mobile robot" as claimed. In order to clarify the distinctions

over the prior art, Applicants have amended Claim 19 herewith to recite that "the motional state is selected from a set of possible motional states, the set comprising at least 'in motion' and 'not in motion.'"

In view of the foregoing, Applicants respectfully submit that it is improper to combine Lawton and Mizuki in the manner suggested by the Examiner, and that even if Lawton and Mizuki were to be combined, the combination still does not teach or suggest the invention as claimed in Claim 19. Accordingly, Applicants request the Examiner to withdraw the rejection to Claim 19 and to allow amended Claim 19.

Discussion of Rejection of Claim 50 Under 35 U.S.C. § 103(a) over Lawton in view of Mizuki

The Examiner rejects Claim 50 under 35 U.S.C. § 103(a) as unpatentable over Lawton in view of Mizuki together with the rejection of Claim 19. Applicants respectfully traverse the Examiner's rejection of Claim 50. In addition, to the extent that the language used in the Examiner's rejection of Claim 50 varies from the language of Claim 50, Applicants respectfully disagree with the paraphrasing.

As discussed earlier in response to the Examiner's rejection of Claim 19, Applicants respectfully submit that it is not proper to combine Lawton and Mizuki in the manner suggested by the Examiner.

Also, as discussed earlier in response to the Examiner's rejection of Claim 19, even if Lawton and Mizuki were to be combined, a combination of Lawton and Mizuki does not teach or suggest detection of "the motional state of the mobile robot." Rather, Lawton assumes and even appears to require that motion be in existence in order to perform "motion parallax." In addition, as Applicants explained earlier, Mizuki relates to "estimating the motion of objects between a present image frame and a reference image frame," for video coding, see Col. 5, lines 34-36. Thus, neither Lawton nor Mizuki, alone or in combination, teaches or suggests "a means for using the characterization of the pixels to compare a first video image to a second video image to detect the motional state of the mobile robot," as claimed.

In order to clarify the distinctions over the prior art, Applicants have amended Claim 50 herewith to recite that "the motional state is selected from a set of possible motional states, the set comprising at least 'in motion' and 'not in motion.'"

In view of the foregoing, Applicants request the Examiner to withdraw the rejection to Claim 50 and to allow amended Claim 50.

Discussion of Rejection of Dependent Claims 20-26

Dependent Claims 20-26 depend from and further define Claim 19. The dependent claims recite numerous additional distinctions over the cited references.

For example, dependent Claim 22 recites "computing a sloppy Exclusive-OR ('sloppy XOR') operation between the binary value and the group of binary values." Contrary to the Examiner's assertions, Applicants respectfully submit that Mizuki does not teach or suggest a sloppy XOR operation.

Rather, Mizuki teaches a conventional XOR operation. "To provide a binary block matching architecture, each processing element 38 is provided having a 1-bit XOR gate. Thus, processing element 38" includes a logic circuit 77 which implements an exclusive or logic function (X-OR)." See Col. 10, lines 14-17. See also, reference 77 of Figure 4. "Each processing element compares via an exclusive-or logic function the value of a search window pixel shifting through the processing element and the present block pixel stored in the standing data register 74." See Col. 10, lines 35-39. Thus, Mizuki's "exclusive-or logic function" compares the value of one pixel to another pixel and not "between the binary value and the group of binary values," as claimed. For illustrative examples of a sloppy XOR operation, see paragraphs [0075] and [0076], and see also the corresponding tables.

In addition, Applicants respectfully submit that the rejections to dependent Claims 20-26 are moot in light of the patentability of Claim 19, and Applicants accordingly request allowance of Claims 20-26.

Discussion of New Claim 53

Claim 53 has been added. Claim 53 depends from and further defines Claim 19. Claim 53 is supported by paragraph [0086] and by Figures 4B, 5B, and 6B. In view of the patentability of Claim 19 and the additional distinctions over the cited art recited by Claim 53, Applicants respectfully request allowance of Claim 53.

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Summary

In view of the foregoing remarks, Applicants respectfully request the Examiner to withdraw the rejections of Claims 19-26 and 50 under 35 U.S.C. § 103(a). In addition, Applicants respectfully submit that Claim 53 is in condition for allowance. Accordingly, Applicants respectfully request the Examiner to pass the present application to the issue process.

If there is any further impediment to the prompt allowance of the present application, Applicants request the Examiner to call the undersigned attorney of record at 310-407-3466 or at the telephone number listed below to resolve any such impediment.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

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